

# Has Perchlorate in Drinking Water Increased the Rate of Congenital Hypothyroidism?

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*Perchlorate, known to inhibit the human thyroid at doses above 200 mg/day, was detected in the drinking-water supplies of seven counties in California and Nevada at levels of 4 to 16 µg/L in 1997. The data from the neonatal screening programs of the state health departments in these two states were analyzed for any increased incidence of congenital hypothyroidism in those counties. County-specific, ethnicity-specific data for Nevada and California were obtained for 1996 and 1997. Within these seven counties, nearly 700,000 newborns had been screened. In all, 249 cases were identified, where 243 were expected, for an overall risk ratio of 1.0 (95% confidence interval, 0.9 to 1.2). The risk ratios for the individual counties ranged between 0.6 and 1.1. These data in this ecological analysis do not indicate an increase in the incidence of congenital hypothyroidism with the reported perchlorate levels.*

Congenital hypothyroidism is a preventable cause of mental retardation and is detected at birth by use of neonatal screening programs. Perchlorate, now a known environmental contaminant of drinking and surface waters, is known to block thyroid-hormone formation by competitively inhibiting the uptake of iodine by the thyroid gland. An analysis has been conducted to determine whether the counties with perchlorate-contaminated water have an increased rate of congenital hypothyroidism.

## Methods

The perchlorate contamination in California and Nevada originated from industrial sites manufacturing or using perchlorate for missiles, rockets, or fireworks. Contamination below an industrial site in Nevada led to contamination of Lake Mead. Lake Mead is the source of the Colorado River water supply for southern California and the water supply for Las Vegas (Clark County), Nevada. Perchlorate concentrations in the Colorado River water have been measured at 5 to 8 parts per billion (ppb) (µg/L). Perchlorate concentrations in the Clark County water supply have been measured at up to 16 ppb.<sup>1</sup> The US Environmental Protection Agency Region 9 has identified six counties in California and one in Nevada as having perchlorate in the drinking-water supply (Fig. 1).

The state health departments in Nevada and California have conducted neonatal screening programs

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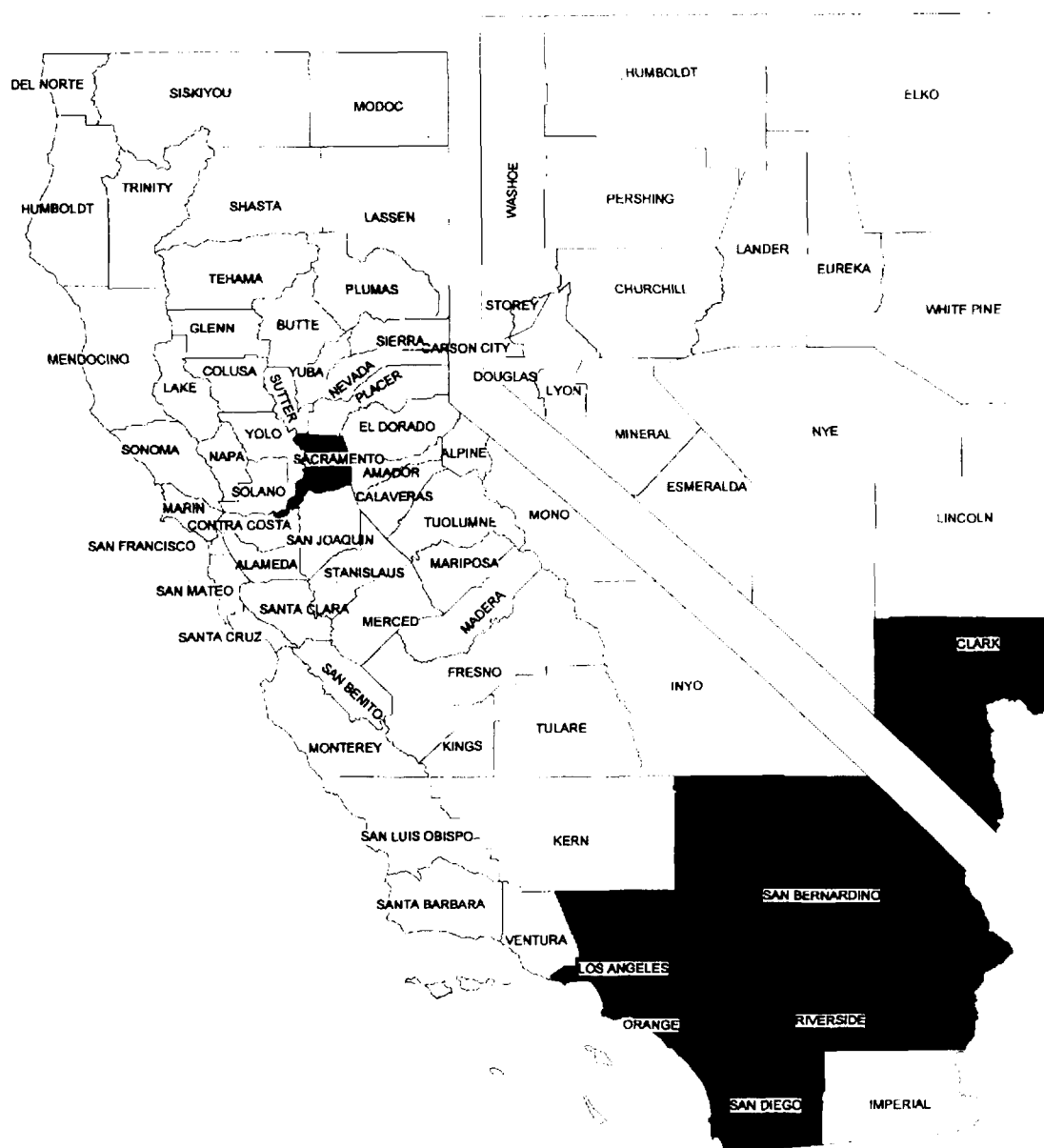


Fig. 1. Counties in California and Nevada with perchlorate detected in drinking water.

for congenital hypothyroidism for over 10 years. A heel-stick blood sample of all newborns is used to assess the presence of a variety of congenital metabolic diseases. Participation is mandatory and covers all hospitals with birthing units. Follow-up after diagnosis and referral for treatment are supervised by the state health departments.

The county-specific congenital hypothyroidism case counts and live birth counts for 1996 and 1997 were obtained for California and Nevada. These data were supplied by the respective state health departments (George Cunningham, MD, MPH, Chief of the Genetics Disease Branch, Primary Care and Family Health Division, California

Department of Health Services; Gloria Deyhle, Bureau of Family Health Services, Nevada State Health Division). The California data were stratified by ethnicity because 50% of children born in California are Hispanic, and Hispanic ethnicity has been shown to be a risk factor for congenital hypothyroidism.<sup>2</sup>

TABLE 1

Congenital Hypothyroidism Cases (Observed and Expected\*) for 1996 and 1997 in Nevada and California Counties With Perchlorate Reported in the Water Supply

State/County	Newborns (number screened)	Congenital Hypothyroidism Cases		Ratio of Observed/ Expected	95% Confidence Limits
		Observed	Expected		
Nevada					
Clark	36,016	7	8.3	0.8	0.34 to 1.74
California					
Los Angeles	338,934	136	123.5	1.1	0.92 to 1.30
Orange	101,227	40	35.9	1.1	0.80 to 1.52
Riverside	43,577	11	15.6	0.7	0.35 to 1.26
Sacramento	39,235	8	12.9	0.6	0.27 to 1.22
San Bernardino	51,637	17	18.4	0.9	0.54 to 1.48
San Diego	80,582	30	28.2	1.1	0.72 to 1.52
Total	655,192	242	234.6	1.0	0.90 to 1.16
All seven counties	691,208	249	42.9	1.0	0.90 to 1.16

\* Expected numbers have been adjusted for Hispanic ethnicity.

## Results

California and Nevada comprise a population of approximately 35 million people, with a birth rate of approximately 16%. The neonatal screening programs cover essentially 100% of the live births in each state, including the 700,000 newborns who were screened during 1996 and 1997 in the seven counties with perchlorate-contaminated drinking water.

On the basis of state incidence rates of congenital hypothyroidism, 243 cases would have been expected in the seven-county area during 1996 and 1997, and 249 cases were observed (Table 1). This risk ratio is 1.0 (95% confidence limits, 0.9 to 1.2). The risk ratios (congenital hypothyroidism standardized birth prevalence ratio) were calculated for the individual counties and ranged between 0.6 and 1.1. Thus, in Nevada and California, the counties with detectable levels of perchlorate in the drinking water had congenital hypothyroidism prevalence rates that did not differ from those expected on the basis of state rates.

Nearly the entire water supply for Clark County, Nevada, comes from the primary source of perchlorate contamination (Lake Mead). The California counties have more spotty

and intermittent exposure. Nonetheless, this ecological examination of the congenital hypothyroidism data (1996 to 1997) shows no increase in the prevalence of congenital hypothyroidism in counties with perchlorate detected in the drinking water.

## Discussion

Perchlorate was detected in the range of 4 to 16 ppb ( $\mu\text{g/L}$ ) in drinking-water supplies for California and Nevada. Assuming a water-intake level of 2 liters per day per person, this might provide a daily dosage of perchlorate of approximately 20  $\mu\text{g}$  per day per person. A daily intake rate of perchlorate at 20  $\mu\text{g}$  per day can be compared with the minimum effective dose of 200 mg/day (200,000  $\mu\text{g/day}$ ) that has been used medically to suppress the thyroid in the treatment of hyperthyroidosis.

Congenital hypothyroidism occurs when both the maternal thyroid and the fetal thyroid are unable to supply adequate thyroid hormone to the fetus. This occurs endemically only in the presence of severe iodine deficiency, a condition rarely known in the United States, and sporadically with structural or metabolic defects

in the thyroid. Children born without a thyroid have normal intellect, if thyroid treatment starts early, because the maternal thyroxine that crosses the placenta is usually sufficient to sustain the fetus.<sup>3-5</sup> Even moderate iodine deficiency in a population yielded only transient changes in thyroid hormone levels (thyroxine, thyroid-stimulating hormone) and no increase in congenital hypothyroidism.<sup>6</sup>

Comparison of the county-specific rates of congenital hypothyroidism (based on prevalence rates derived from mandatory reporting programs) in California and Nevada reveal that counties with perchlorate detected in the drinking water do not have higher rates of congenital hypothyroidism. These data, at an ecological level of analysis, seem to indicate that no increased rate of congenital hypothyroidism is associated with the levels of perchlorate found in the drinking water of California and Nevada.

## Acknowledgment

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